NCI Cancer Imaging Informatics Workshop
September 26, 2002

# *Image-guided Therapy Center*
# *Washington University*
# *Saint Louis, Missouri*


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Associate Director, Operations


Image-Guided Therapy Center
An Advanced Technology Clinical Trials QA and Support Center

Image-Guided Therapy Center — An Advanced Technology Clinical Trials QA and Support Center

# *IMAGE-GUIDED THERAPY CENTER*

## *Acknowledgements*

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- J. A. Purdy, Ph.D. — Director
- Walter Bosch, D.Sc. — Assoc. Director, Operations
- Jeff Michalski, M.D. — Assoc. Director, Clinical
- Bill Straube, M.S. — Medical Physicist
- John Matthews, D.Sc. — Computer Scientist
- Sean O'Leary, M.S. — Programmer Analyst

# *ITC HISTORY*

- April 1992 3DQA Center established at WU-St. Louis to provide QA for RTOG 3DCRT clinical trials.
- May 1993 RTOG & 3DQA Center awarded NCI grant for Operation/ Statistical Center for prostate dose escalation study (3DOG).
- April 1999 NCI funded two Advanced Technology QA Centers
  - Advanced Technology QA Consortium
    - 3DQA Center ➔Image-guided Therapy Center (ITC)
    - RPC
    - QARC
    - RTOG
  - Resource Center for Emerging Technology (University of Florida)

# NCI ADVANCED TECHNOLOGY QA CONSORTIUM

- In 2002, NCI has restructured the grant creating a single Advanced Technology Consortium (ATC) to support QA for advanced technology clinical trials (P.I. J. A. Purdy, Ph.D.)
- ATC consists of ITC, RCET, RPC, QARC, RTOG HQ Dosimetry
- New consolidated approach will eliminate duplication of effort and facilitate sharing of QA resources among cooperative groups.
- ATC will help ensure that appropriate and uniform QA procedures and criteria are developed for advanced technology trials.

# *Advanced Technology QA Consortium*

*Capitalizes on Infrastructure/Strengths of Existing National QA Programs*

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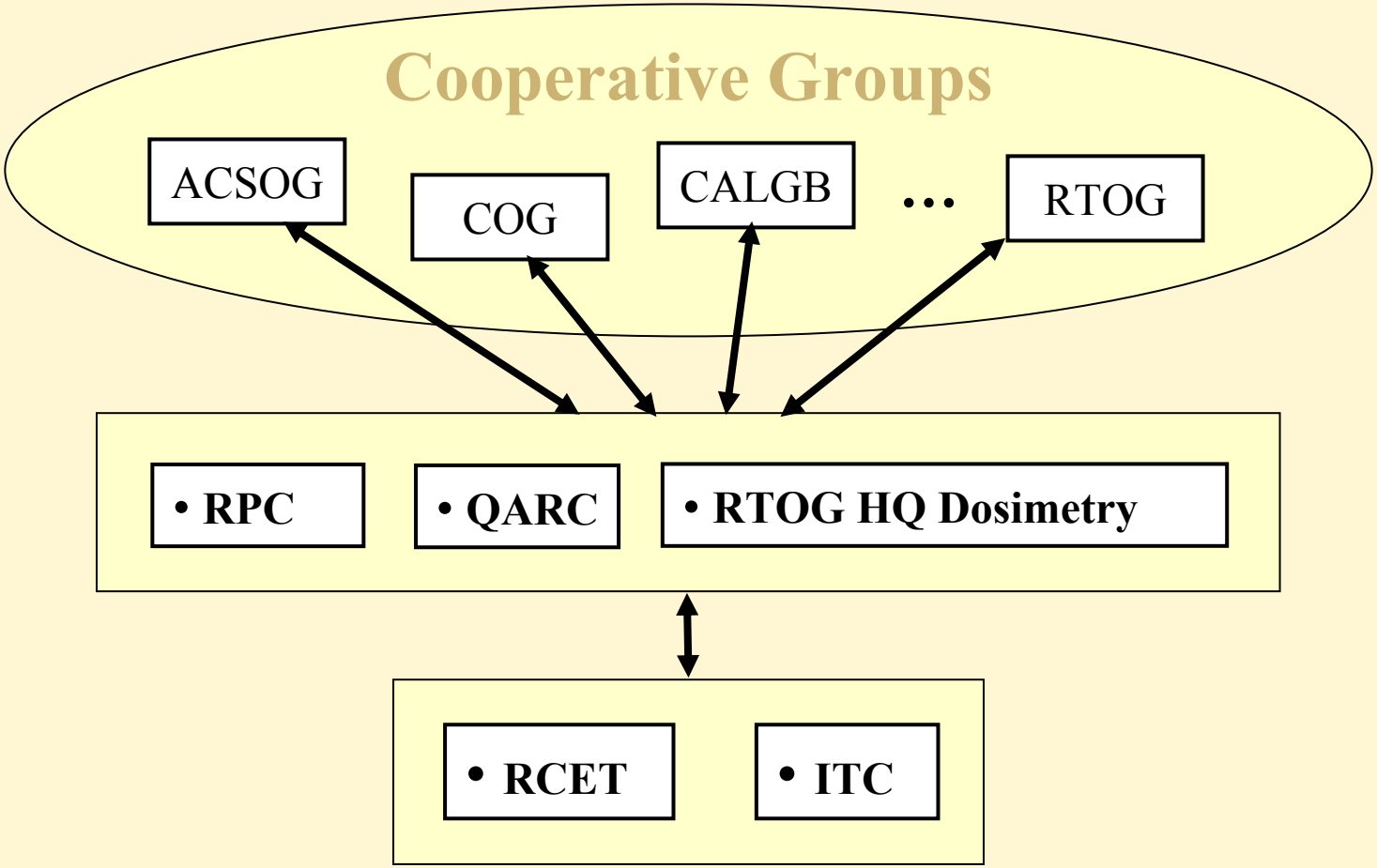
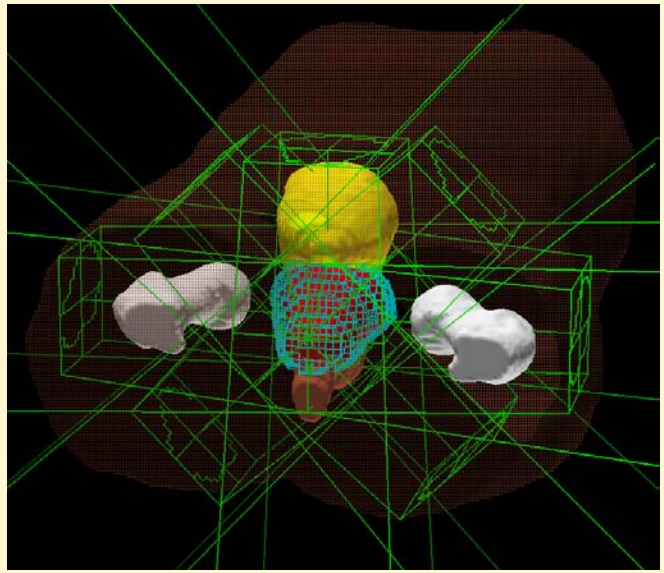



ITC and RCET provide a digital data exchange mechanism for existing QA Centers that serve various cooperative groups.

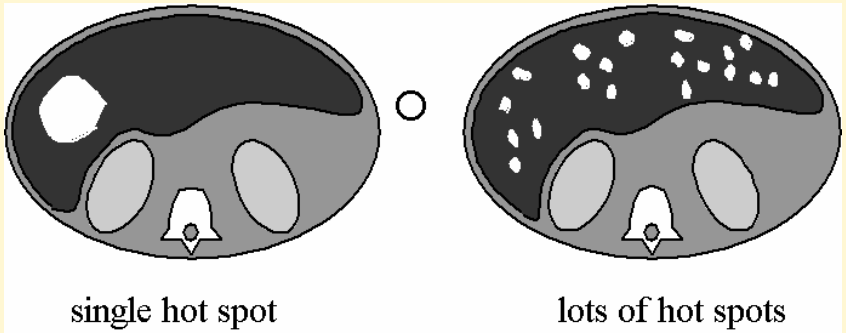
# *ITC's Original Challenge*

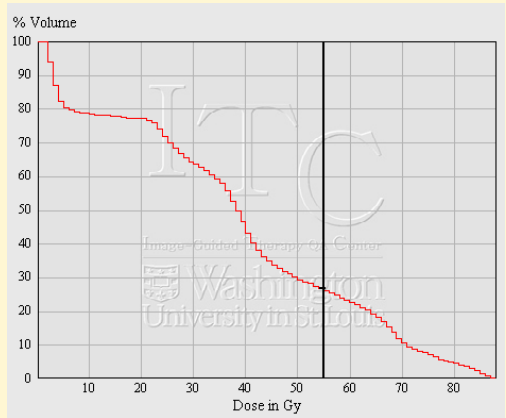
- Define basic technical and clinical QA criteria for participation in RTOG 3DCRT protocols
  - Protocol development/nomenclature
  - Facility questionaire
  - Dry run
- Develop treatment planning and verification (TPV) data exchange mechanism for participants
  - RTOG Data Exchange
  - DICOM RT Objects
- Develop QA program to review submitted TPV data
  - QA guidelines
  - Software tools



# *What's Special About 3D Treatment Planning/Verification (TPV) Data?*

- Linkage of TPV data to clinical outcomes
  - Evaluating response statistics
  - Developing dose-response models.
- DVHs alone are not sufficient
  - Different dose distributions throughout an organ may lead to different expectations of toxicity for some organs.
  - Loss of Spatial Information in DVHs



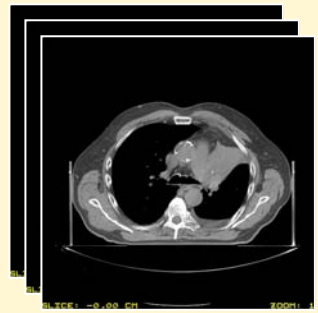



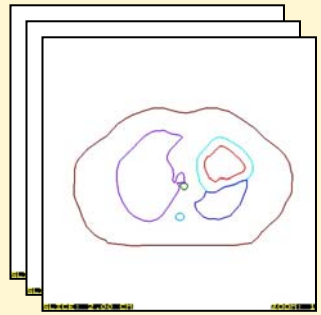

White zones represent higher dose areas.

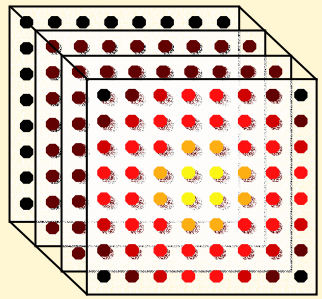
# DIGITAL DATA EXCHANGE

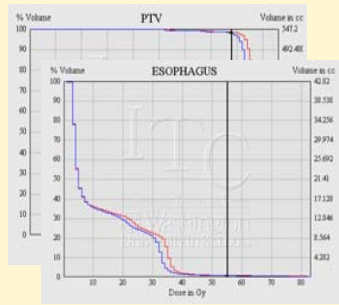
## TPV Data Submitted to ITC

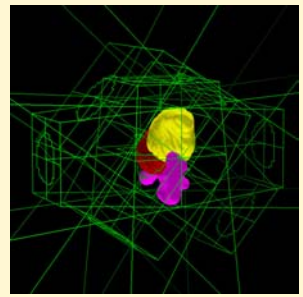
- ITC has pioneered digital data exchange mechanisms of treatment planning-verification data for use in clinical trials.
  - Patient Volumetric CT Data Set
  - Contours: GTV, CTV, PTV, OAR's
  - Volumetric 3-D Dose Distribution Data (Including Fractionation)
  - Dose-Volume Histograms
  - Beam Modality/Geometry Specification
  - Digital Simulator and Portal Images









# IMAGE-GUIDED THERAPY CENTER

## Digital Data Submission

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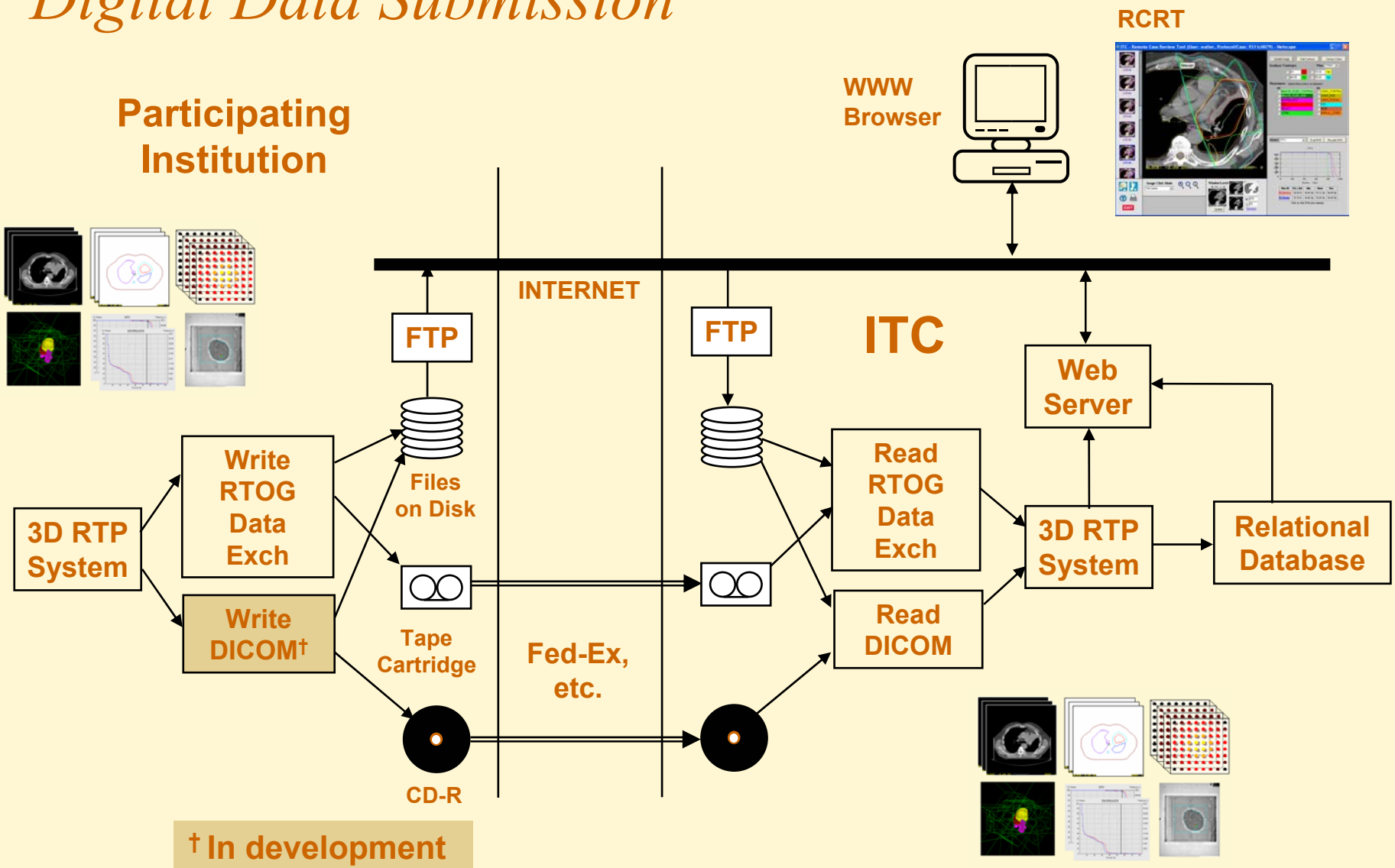


† In development

# ITC Remote Case Review Tool

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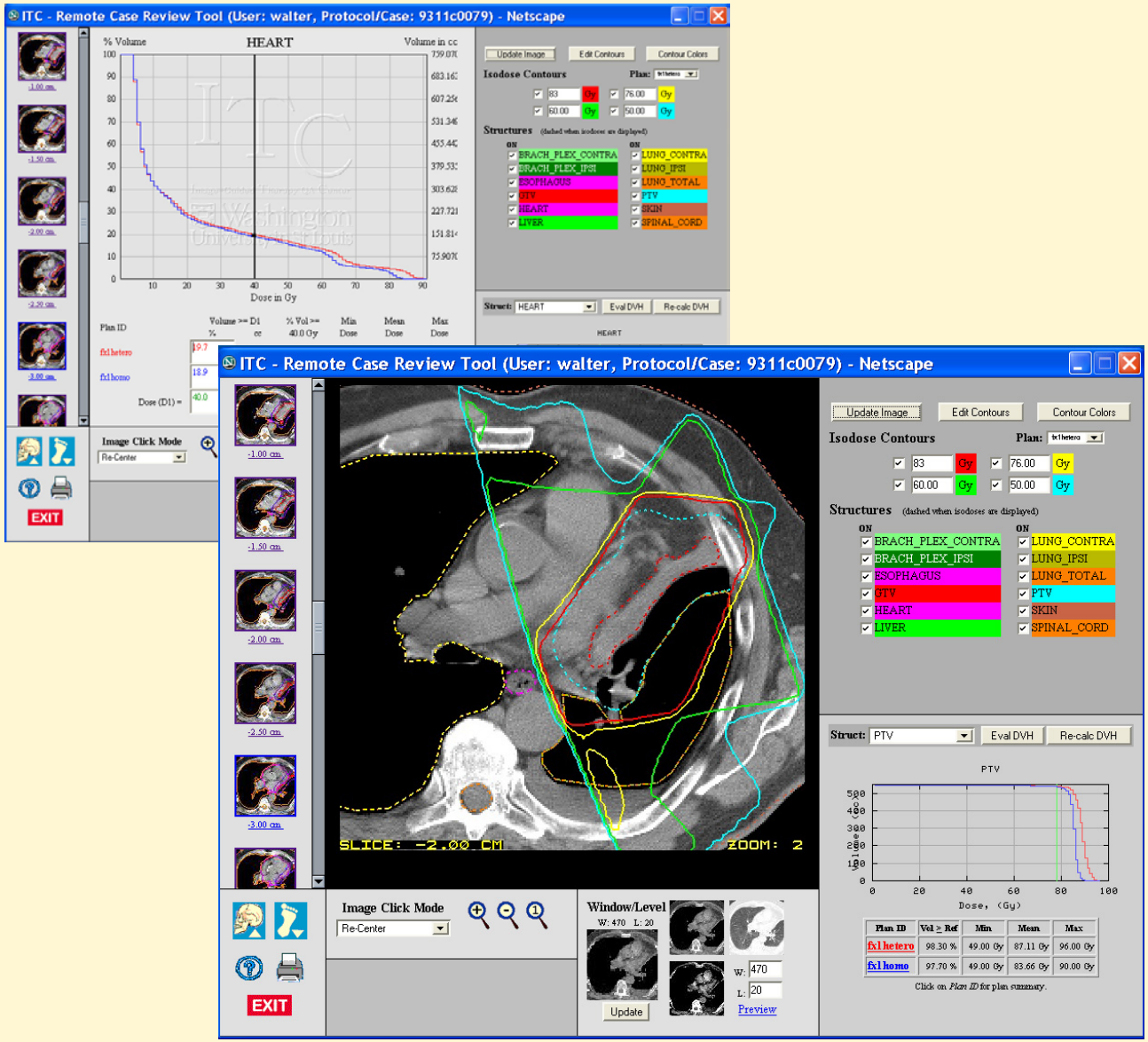
- Data Exchange
- CT Scan
- Organs at Risk Contours
- Target Volumes Contours
- Dose Prescription
- Dose uniformity



# *RTOG Advanced-Technology Protocols*

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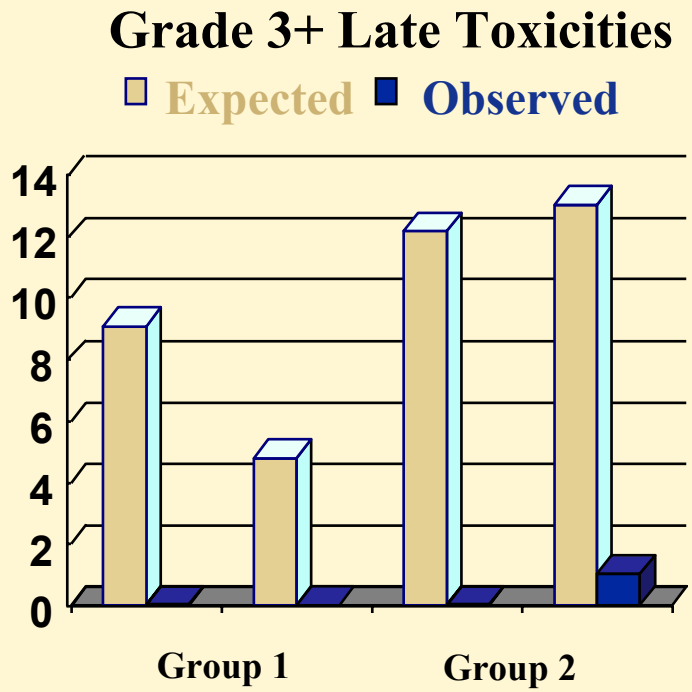
| RTOG Protocol | Site | Status | Approved Institutions | Accrued Cases* |
|---|---|---|---|---|
| 9406 | Prostate Ph I/II | Closed | 53 | 1084 |
| 9311 | Lung Ph I/II | Closed | 26 | 180 |
| 9803 | Brain (GBM) Ph I/II | Open | 43 | 151 |
| H-0022 | Nasopharynx (IMRT) Ph I/II | Open | 8 | 16 |
| L-0117 | Lung Ph I/II | Open | 30 | 8 |
| P-0126 | Prostate Ph III | Open | 57 | 14 |

* as of 9/16/2002

# RTOG 94-06 3DCRT PROTOCOL

*A Phase I/II Dose Escalation Study Using 3D Conformal Radiation Therapy for Adenocarcinoma of the Prostate*

- **53 institutions credentialed to enroll patients on study.**
- **Dose Levels**
  - **68.4 Gy (1.8 Gy/fraction)**
  - **73.8 Gy (1.8 Gy/fraction)**
  - **79.2 Gy to GTV; 73.8 Gy to PTV (1.8 Gy/fraction)**
  - **74.0 Gy to PTV (2 Gy/fraction)**
  - **78.0 Gy to PTV (2 Gy/fraction)**
- **Accrual History**
  - **May 2, 1994 Activation Date**
  - **Oct 31, 2000 1084 Patients (study closed)**




*Michalski, J.M., Purdy, J.A., Winter, K., et al. IJROBP 46(2):391-402, 2000.*

# *Linking Digital Treatment Planning Data to Outcomes*

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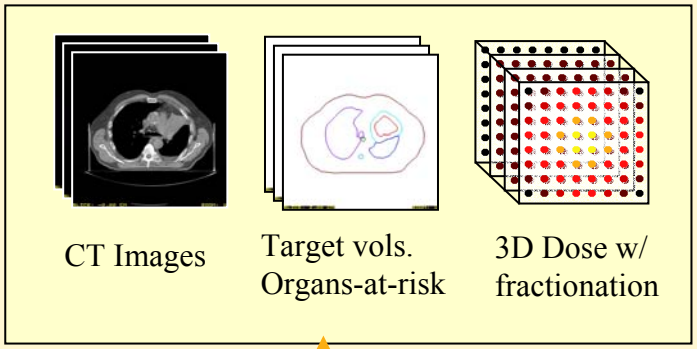


OUTCOMES

- Normal-tissue complications
- Tumor control

- Early attempts
  - Exchanges of Dose-Volume and Toxicity abstracts between RTOG HQ and ITC.
  - M. Roach retrospective study using RCRT to contour penile bulb.
- New (planned) initiative
  - Dose-response modeling using RTOG 9406 data

# *Data Exchange Technical Workshops for RTP Vendors*

- Mar 10, 1995, St. Louis: implementation of RTOG Data Exchange standard for participation in multi-institutional clinical trials.
- Sep 10-11, 1999, St. Louis: implementation of RTOG Data Exchange standard (emphasis on prostate brachy).
- March 16-17, 2001, St. Louis: implementation of DICOM 3.0 standard for participation in multi-institutional clinical trials.
- March 16, 2002, St. Louis: implementation of DICOM 3.0 standard for participation in multi-institutional clinical trials.

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# SUMMARY AND CONCLUSION

- ITC has been in operation for nearly a decade and has provided RTOG the unique ability to conduct 3DCRT and IMRT multi-institutional clinical trials in which volumetric 3D treatment planning data can be collected, reviewed, analyzed, and linked to clinical outcomes.
- The **newly integrated ATC** is now in a position to extend these capabilities to a broad range of cooperative-group, advanced-technology clinical trials.